

Application Serial No. 10/649,577
Attorney Docket No.: 0140153**REMARKS**

By the present amendment and response, claims 1, 22, 27, and 28 have been amended and claims 3 and 4 have been cancelled. Accordingly, claims 1, 2, 5-8, 16, 17, and 20-28 remain in the present application. Reconsideration and allowance of pending claims 1, 2, 5-8, 16, 17, and 20-28 in view of the following remarks are requested.

A. Rejection of Claims 1, 16, 20, 24, and 26 under 35 USC §102(b)

The Examiner has rejected claims 1, 16, 20, 24, and 26 under 35 USC §102(b) as being anticipated by U.S. patent number 4,944,087 to Vincent R. Landi (hereinafter "Landi"). For the reasons discussed below, Applicants respectfully submit that amended independent claim 1 is patentably distinguishable over Landi.

Amended independent claim 1 recites, among other things, attaching a removable material comprising a soluble adhesive to a surface of a conductive material, forming a die attach pad within the conductive material, coupling an electronic device to the die attach pad, and removing the removable material from conductive features formed within the conductive material, the die attach pad, and encapsulant by dissolving the soluble adhesive, thereby forming a package for the electronic device. As disclosed in the present application, in one embodiment removable tape 310, which can comprise, for example, a polyimide material and a water soluble material, is attached to metal frame 300 to prevent the adhesion of encapsulant to bottom surface 320 of frame 300.

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As stated in the present application, after the structure including connector 120, die attach pad 130, wire 140, and electronic device 150 has been formed and encapsulated with molding compound, tape 310, which comprises a soluble adhesive, can be removed by immersing it (i.e. tape 310) in hot water so as to dissolve the soluble adhesive. Thus, in an embodiment of the present invention, tape 310 is removed by dissolving only the soluble adhesive that attaches the tape to connector 120, die attach pad 130, and the encapsulant. Thus, by using an adhesive material that is water soluble, an embodiment of the invention's method for forming an electronic device package provides a removable material for protecting a bottom surface of a frame from encapsulating material, where the removable material can be inexpensively and easily removed.

In contrast to amended independent claim 1, Landi does not teach, disclose, or suggest forming a die attach pad within a conductive material, coupling an electronic device to the die attach pad, and removing a removable material from conductive features formed within the conductive material, the die attach pad, and encapsulant by dissolving the soluble adhesive, thereby forming a package for the electronic device. Landi generally discloses a method for embedding a circuit pattern into the surface of a three-dimensional molded object. *See, e.g.*, the "Summary of the Invention" section of Landi. Landi specifically discloses a method including steps of forming a metallic circuit pattern on a flexible substrate, where the circuit pattern is bonded to the substrate by an adhesive layer between the circuit pattern and the substrate, placing the flexible circuit into a mold

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cavity, forcing molding compound against the flexible circuit and curing the molding compound to define an article, and removing the adhesive layer to release the flexible substrate from the article while leaving the circuit pattern embedded on the surface of the article. *See, e.g.,* claim 1 of Landi. Thus, in Landi, a circuit pattern is transferred from a flexible substrate and embedded into molding compound.

However, Landi fails to teach, disclose, or suggest forming a die attach pad within a conductive material, coupling an electronic device to the die attach pad, and removing a removable material from conductive features formed within the conductive material, the die attach pad, and encapsulant by dissolving the soluble adhesive, thereby forming a package for the electronic device, as specified in amended independent claim 1. In fact, the method disclosed in Landi, i.e., embedding a circuit pattern on a flexible substrate into molding compound, is unrelated to the method of forming a package for an electronic device as specified in amended independent claim 1.

For the foregoing reasons, Applicants respectfully submit that amended independent claim 1 is not suggested, disclosed, or taught by Landi. As such, amended independent claim 1 is patentably distinguishable over Landi. Thus, claims 16, 20, 24, and 26 depending from amended independent claim 1 are also patentably distinguishable over Landi for at least the reasons presented above and also for additional limitations contained in each dependent claim.

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B. Rejection of Claims 1-6, 16, and 20-27 under 35 USC §103(a)

The Examiner has rejected claims 1-6, 16, and 20-27 under 35 USC §103(a) as being unpatentable over U.S. patent number 6,001,671 to Joseph Fjelstad (hereinafter "Fjelstad") taken with Landi. For the reasons discussed below, Applicants respectfully submit that amended independent claim 1 is patentably distinguishable over Fjelstad and Landi, either singly or in combination thereof.

In contrast to the present invention as defined by amended independent claim 1, Fjelstad does not teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive, and removing the removable material from conductive features formed within the conductive material and from an encapsulant by dissolving the soluble adhesive. Fjelstad specifically discloses patterning conductive pads 110' and conductive region 115' in conductive layer 101', which is situated on sacrificial layer 100', bonding semiconductor chip 120' to conductive region 115', electrically connecting semiconductor chip 120' to conductive pads 110' by wirebonding wires 130', and encapsulating conductive pads 110', conductive region 115', semiconductor chip 120', and wirebonding wires 130'. *See, e.g.*, column 5, lines 27-46 and Figures 2A-2D of Fjelstad. In Fjelstad, conductive layer 101' is situated on one surface of sacrificial layer 100'. However, Fjelstad fails to teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a

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soluble adhesive, as specified in amended independent claim 1. In fact, Fjelstad does not even mention attaching a removable material to a surface of a conductive material.

In Fjelstad, portions of dielectric polymer sheet 100' are then removed by chemical etching or laser ablation operations so as to expose pads 110' and conductive region 115'. *See, e.g.*, Fjelstad, column 5, lines 46-49. If a wiring layer is not needed, Fjelstad discloses that the entire sacrificial layer 100' may be removed by chemically dissolving the sheet. *See, e.g.*, Fjelstad, column 5, lines 60-65. Thus, in Fjelstad, a portion of sacrificial layer 100' may be removed by etching or laser ablation or the entire sacrificial layer may be removed by chemically dissolving it if a wiring layer is not needed. In contrast, amended independent claim 1 specifies a removable material comprising a soluble adhesive, where the removable material is removed from conductive features by dissolving the soluble adhesive. Thus, in Fjelstad, the sacrificial layer must be removed by actually dissolving it, whereas in the invention as defined by amended independent claim 1, the removable material is removed by dissolving the soluble adhesive in, for example, hot water. In contrast, the sacrificial layer disclosed in Fjelstad cannot be dissolved in water. Furthermore, Fjelstad fails to teach, disclose, or suggest a soluble adhesive.

On page 4 of the Office Action dated April 26, 2007, the Examiner states that "the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to attach the removable material 100' to the film of

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conductive material 101' of Fjelstad by employing a removable material comprising a soluble adhesive for attaching to the conductive material, as taught by Landi." The Examiner further states that "[t]his is also because of the desirability to simplify and facilitate the removal of the removable material comprising the soluble adhesive from the encapsulated device by simply dissolving the adhesive in a solvent." Fjelstad, however, discloses removing portions of polymer sheet 100' (removable material), as by chemically etching or laser ablation operations, so that pads 110' and central conductive region 115' are exposed. *See, e.g.*, column 5, lines 46-49 of Fjelstad. If a soluble adhesive were utilized to attach removable material 100' to conductive material 101' as suggested by Examiner, however, Applicants submit that it would not be possible to dissolve only portions of removable material 100' in a solution without undesirably dissolving (i.e., removing) all of the removable material. Thus, Applicants respectfully submit that utilizing a soluble adhesive to attach removable material 100' to conductive material 101' in Fjelstad as suggested by Examiner would not provide a sufficient benefit or would even work in Fjelstad, and for the reasons stated above, Fjelstad's approach in fact teaches away from the invention of claim 1.

As discussed above, Landi discloses a method for embedding a circuit pattern into the surface of a three-dimensional molded object. In Landi, a flexible substrate and adhesive are removed from a molded part by utilizing a solvent that will dissolve an adhesive without dissolving the molded part. *See, e.g.*, column 3, lines 18-26 of Landi.

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In contrast, Fjelstad discloses a method of manufacturing a semiconductor chip package, where a sacrificial layer is used as a base to selectively form an array of conductive pads such that a central region is defined by the pads. *See, e.g.*, the Abstract of Fjelstad. Thus, since Landi is totally unrelated to manufacturing semiconductor chip packages, Applicants respectfully submit that a person of ordinary skill in the art would not have been motivated to combine Fjelstad with Landi as suggested by the Examiner.

For the foregoing reasons, Applicants respectfully submit that amended independent claim 1 is not suggested, disclosed, or taught by Fjelstad and Landi, singly or in combination thereof. As such, amended independent claim 1 is patentably distinguishable over Fjelstad and Landi. Thus, claims 2, 5, 6, 16, and 20-27 depending from amended independent claim 1 are also patentably distinguishable over Fjelstad and Landi for at least the reasons presented above and also for additional limitations contained in each dependent claim.

C. Rejection of Claims 7-8 and 17 under 35 USC §103(a)

The Examiner has rejected claims 7-8 and 17 under 35 USC §103(a) as being unpatentable over Fjelstad and Landi, as applied to claims 1-6, 16, 20-27, taken with U.S. patent number 6,111,199 to Wyland et al. (hereinafter "Wyland") and Weng et al. (hereinafter "Weng"). For the reasons discussed below, Applicants respectfully submit

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that claims 7-8 and 17 are patentably distinguishable over Fjelstad, Landi, Wyland, and Weng, either singly or in any combination thereof.

Claim 7 includes, in addition to the limitations of base claim 1 discussed above, the limitation "wherein the removable material is water soluble adhesive." Landi specifically discloses removing an adhesive from molded plastic by a chemical agent, solvent or high temperature. *See, e.g.*, column 5, lines 28-32 of Landi. However, Landi fails to teach, disclose, or suggest a removable material that is a water soluble adhesive. As discussed above, Fjelstad fails to teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive.

Wyland specifically discloses package 320 including ring 322, which is mounted on substrate 324 underneath leads 321I and 321J to support each lead during wire bonding so as to *prevent the leads from deforming due to pressure applied by the wire bonding machine*. *See, e.g.*, column 7, lines 33-36 and Figure 3B of Wyland. In Wyland, ring 322 is not attached, either permanently or temporarily to the leads, but merely keeps the leads from collapsing during wire bonding. *See, e.g.*, column 7, lines 44-48 and Figure 3B of Wyland. In Wyland, ring 322, which can include an adhesive that can be, for example, a water-soluble resin composition, can be dissolved in a solvent after wire bonding. *See, e.g.*, Wyland, column 7, lines 48-67 and column 8, lines 1-3.

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However, Applicants respectfully submit that the structure and use of ring 322 is significantly different than the sacrificial layer in Fjelstad or the flexible substrate in Landi. In particular, the sacrificial layer in Fjelstad is utilized to protect bottom surfaces of conductive pads and a conductive region from encapsulant and the flexible substrate in Landi is utilized to form and transfer a circuit pattern to a cured mold compound. In contrast, ring 322 is mounted on a substrate under leads to prevent the leads from deforming due to pressure applied to the leads by a wire bonding machine. Also, in Fjelstad, the sacrificial layer comprises a dielectric polymer sheet (e.g. dielectric polymer sheet 100') having a conductive layer (e.g. conductive layer 101') on one surface, while ring 322 in Wyland can comprise, for example, filler particles (such as sand particles) dispersed in an adhesive. As such, Applicants respectfully submit that there is no motivation to combine Fjelstad, Landi, and Wyland as suggested by the Examiner. Furthermore, Applicants respectfully submit that a person of ordinary skill in the art would not have seen a benefit in combining Fjelstad, Landi, and Wyland, since, as discussed above, utilizing a soluble adhesive to attach sacrificial layer 100' to conductive layer 101' is not desirable or would even work in Fjelstad.

Weng is directed to splatter-free and debris-free wafer marking process in which a marked polymeric tape is first mounted onto a wafer surface which is then etched by either a dry etchant or a wet etchant to reproduce the mark in the wafer surface. Weng specifically discloses process 10 including step 60, in which a polymeric based tape is

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removed from the surface of the wafer (or the electronic substrate) to produce a wafer marked with the desirable identification mark. *See, e.g.*, column 5, lines 27-30 and Figure 1 of Weng. However, the debris-free wafer marking method disclosed in Weng is completely unrelated to the method of manufacturing a semiconductor chip package disclosed in Fjelstad, the method of making a curved plastic body with a circuit pattern disclosed in Landi, or an integrated circuit package using a gas to insulate electrical conductors as disclosed in Wyland.

As such, Applicants respectfully submit there is a lack of sufficient motivation to combine Fjelstad, Landi, Wyland, and Weng as suggested by the Examiner. Thus, Applicants respectfully submit that the purported teachings suggested by the Examiner (i.e. the combination of Fjelstad, Landi, Wyland, and Weng) are based on hindsight reconstruction given the benefit of Applicants' disclosure, which is impermissible. Thus, for the foregoing reasons, Applicants respectfully submit that claim 7, which depends from amended independent claim 1, and claim 8, which depends from claim 7, are patentably distinguishable over Fjelstad, Landi, Wyland, and Weng, either singly or in any combination thereof.

Also, claim 17, which depends from amended independent claim 1, includes the limitation "wherein the removable material comprises a polyimide material and a water soluble adhesive." For similar reasons as discussed above, Applicants respectfully submit that a removable material as specified in amended independent claim 1, where the

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removable material comprises a polyimide material and a water soluble adhesive as specified in dependent claim 17, is not taught, disclosed, or suggest by Fjelstad, Landi, Wyland, and Weng, considered either singly or in any combination thereof. Thus, Applicants respectfully submit that claim 17, which depends from amended independent claim 1, is also patentably distinguishable over Fjelstad, Landi, Wyland, and Weng.

D. Rejection of Claim 28 under 35 USC §103(a)

The Examiner has rejected claim 28 under 35 USC §103(a) as being unpatentable over Fjelstad and Landi, as applied to claims 1-6, 16, and 20-27, further taken with U.S. patent number 4,530,152 to Roche et al. (hereinafter "Roche"). For the reasons discussed below, Applicants respectfully submit that amended independent claim 28 is patentably distinguishable over Fjelstad, Landi, and Roche, either singly or in combination thereof.

Amended independent claim 28 includes similar limitations as amended independent claim 1. Thus, for similar reasons as discussed above, amended independent claim 28 is also patentably distinguishable over Fjelstad and Landi. In addition to the limitations in amended independent claim 1, amended independent claim 28 also includes the limitation of removing the removable material from conductive features and encapsulant after the singulation process is performed to separate the package. In contrast, Fjelstad discloses dicing the packages into either individual packages or multichip packages after portions of polymer sheet 100' are removed to expose pads 110'

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and central conductive region 115'. See, e.g., Fjelstad, column 5, lines 46-51. Landi does not teach, disclose, or suggest an electronic device package.

In contrast, Roche does not teach, disclose, or suggest does not teach, disclose, or suggest attaching a removable material to a surface of a conductive material, where the removable material comprises a soluble adhesive, and removing the removable material from conductive features formed within the conductive material and from an encapsulant by , where the removable material is removed from the conductive features and the encapsulant by dissolving the soluble adhesive after a singulation process is performed to separate the package. Roche specifically discloses depositing thin conductive layer 6 of low melting point alloy on metal substrate 7, forming metal connection areas 3 and 4 on alloy layer 6, positioning chip 1 on connection area 4, connecting chip 1 to connection areas 4 by wires 2, and encapsulating chip 1, wires 2, and connection areas 3 and 4 with hardenable resin 5. See, e.g., column 2, lines 60-68, column 3, lines 1-61 and Figures 1, 2, and 3 of Roche.

In Roche, alloy layer 6 is melted by heating it to a relatively low temperature in order to remove temporary metal substrate 7. See, e.g., Roche, column 3, lines 62-64. However, Roche fails to teach, disclose, or suggest attaching a removable material comprising a soluble adhesive to a surface of a conductive material, as specified in independent claim 28. Additionally, Roche states that melting of the alloy layer also leaves a film of tin-lead alloy on the exposed surfaces of the connection areas, so that the

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tinning operation normally required prior to soldering on the external connections is not required in this instance. *See, e.g., Roche*, column 4, lines 9-13. Thus, Roche teaches away from attaching a removable material comprising a soluble adhesive to a conductive material by dissolving the soluble adhesive, since a soluble adhesive does not provide the advantage of eliminating a tinning operation that is achieved in Roche by melting a tin-lead alloy film.

In Roche, each component is separated from the others after encapsulation with and hardening of the resin, by sawing or other cutting technique, and either before or after removal of the temporary substrate. *See, e.g., Roche*, column 4, lines 20-24. On page 6 of the Office Action dated April 26, 2007, the Examiner states that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the removable material of Fjelstad either after a singulation process to separate the package or prior to a singulation process as alternatively taught by Roche." However, as discussed above, Fjelstad discloses dicing the packages into either individual or multichip packages after removing portions of dielectric polymer sheet 100' (i.e., sacrificial material) by chemical etching or laser ablation operations so as to expose pads 110' and conductive region 115'.

As is known by one of ordinary skill in the art, a masking step is required to selectively remove portions of dielectric polymer sheet 100'. Applicants respectfully submit that performing the required masking step on the wafer is significantly easier and

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more cost effective compared to masking each individual package, as is required if portions of dielectric polymer sheet 100' in Fjelstad are removed after the packages have been separated from the wafer. Also, Applicants respectfully submit that a person of ordinary skill in the art would not have seen a benefit to removing portions of the dielectric polymer sheet after dicing the wafer in Fjelstad that would offset the advantages realized by removing portions of the dielectric polymer sheet from the package before dicing the wafer, as discussed above. Thus, Applicants respectfully submit that there is insufficient motivation to combine or benefit achieved by combining Fjelstad, Landi, and Roche as suggested by the Examiner.

For the foregoing reasons, Applicants respectfully submit that amended independent claim 28 is not suggested, disclosed, or taught by Fjelstad, Landi, and Roche. As such, amended independent claim 28 is patentably distinguishable over Fjelstad, Landi, and Roche.

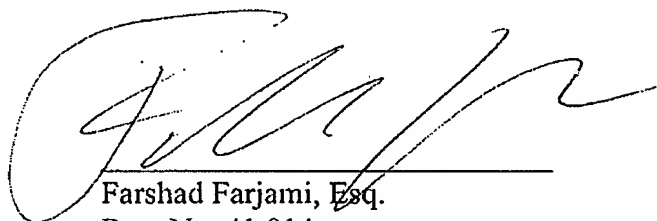
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E. Conclusion

Based on the foregoing reasons, amended independent claims 1 and 28, and claims depending therefrom, are patentably distinguishable over the art cited by the Examiner. For all the foregoing reasons, an early Notice of Allowance for pending claims 1, 2, 5-8, 16, 17, and 20-28 is respectfully requested.

Respectfully Submitted,
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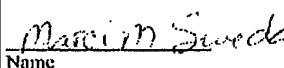
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